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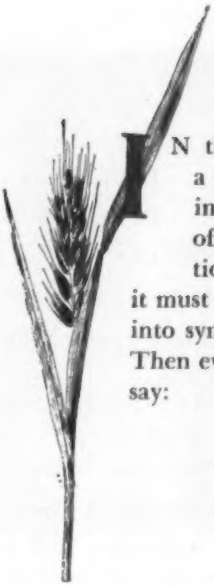


The School House[1]

By L. H. Bailey

IN the rural districts, the school must become a social and intellectual centre. It must stand in close relationship with the life and activities of its community. It must not be an institution apart, exotic to the common-day lives; it must teach the common things and put the pupil into sympathetic touch with his own environment. Then every school house will have a voice, and will say:

I teach

The earth and soil
To them that toil,
The hill and fen
To common men
That live right here;

The plants that grow,
The winds that blow,
The streams that run
In rain and sun
Throughout the year;

And then I lead,
Thro' wood and mead,
Thro' mold and sod,
Out unto God
With love and cheer.

I teach!

[1]Reprinted from *Cornell Nature-Study Leaflets,* Department of Agriculture, State of New York, 1904.

CONTENTS

The Best Teacher

He is the best teacher in any given case who arouses the student to energetic action, directs his efforts in the right way to consistent, worthy, and noble ends; causes him to form manly, tasteful, and proper habits, and creates within him a thirst for knowledge and for personal excellence that will bear him firmly thru all the allurements of dissipation, the dazzling splendor of prosperity, or the deep, dark gloom of poverty.

— Braxton Craven, quoted in "School and Society" July 19, 1952, p 35.

E. LAURENCE PALMER

BY EVA L. GORDON

WITH his retirement from the Faculty of the New York State College of Agriculture at Cornell, which took effect July 24, 1952, Professor Ephraim Laurence Palmer ended thirty-seven years of service to the University. During thirty-three of these years, he has been responsible for the program in nature and science education, and particularly for the Cornell Rural School Leaflet, four numbers of which have gone out each year to the rural schools of New York State and to many readers in other areas.

Professor Palmer is a native New Yorker. He was born in McGraw, and received his early education in the Cortland public schools. After graduation from the Cortland Normal School, now Cortland State Teachers College, he entered Cornell University, where his major interest in botany was developed. During his later undergraduate years and while he was working for his master's degree, he served as an assistant in the Department of Botany. During the six years between 1913 and 1919 he taught botany and elementary agriculture at Iowa State Teachers College in Cedar Falls and helped to develop an elementary agriculture program in the rural schools of Iowa, achieved the degree of Doctor of Philosophy at Cornell, and served in the United States Navy.

He returned to Cornell in 1919 to continue the work in nature-study begun so ably by Mrs. Anna Botsford Comstock, Liberty Hyde Bailey, John W. Spencer, and their associates and successors. In addition to the Cornell Rural School Leaflet, a major responsibility of Professor Palmer's years at Cornell, he has developed courses in field natural history, outdoor living, nature writing, and the teaching of conservation; has served on numerous committees; has spoken before many groups of teachers and in many schools, as well as to many groups, within and outside the State, not identified directly with schools; and has originated and maintained for more than twenty years a weekly radio program, *This Week*

in Nature. When the Department of Conservation was organized at Cornell, he assumed a joint professorship in Rural Education and Conservation. He has been an active and constructive leader in many professional organizations in the field of nature and science education and, in later years, in conservation education. In 1947 he was awarded a Fulbright professorship in New Zealand, where he spent five months teaching, lecturing, and writing. His teaching service, in addition to his work at Cornell, includes summers in California, Iowa, Utah, Washington, and Hawaii. Through his graduate students, his influence has made itself felt in many educational centers. He has given thirty-two years service to Boy Scout work and, in 1947, received the Silver Beaver, Scouting's highest honor.

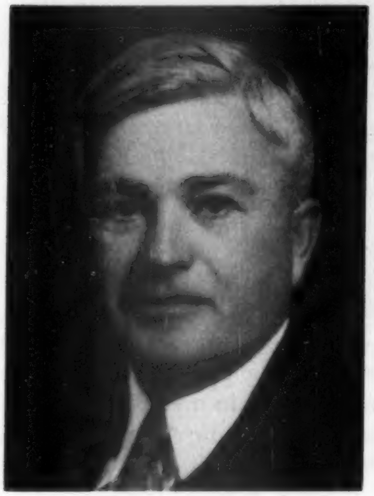
Besides the Leaflets and more than 500 articles, Professor Palmer's writings include several books, the most recent of which is his *Fieldbook of Natural History.* He has served since 1925 as director of nature education for *Nature Magazine,* and since 1935 as editor of the McGraw-Hill Natural History series. He became director of conservation education for the National Wildlife Federation in 1950.

In all these capacities his originality, his dynamic philosophy, his energy and ability to accomplish, and his critical insight into problems have made his contribution unique and extensive.

Professor and Mrs. Palmer will continue to reside in Ithaca, where retirement seems to mean chiefly an opportunity to develop new projects and to produce greater contributions in the fields in which he has worked for so long; and where, we hope, he will still give friendly counsel and lend an occasional helping hand in the work which he is now officially relinquishing.

JULIAN E. BUTTERWORTH

By Eva L. Gordon



On July 1, 1952, Professor Julian E. Butterworth retired from the Faculty of the New York State College of Agriculture at Cornell, with which he had been identified for thirty-three years.

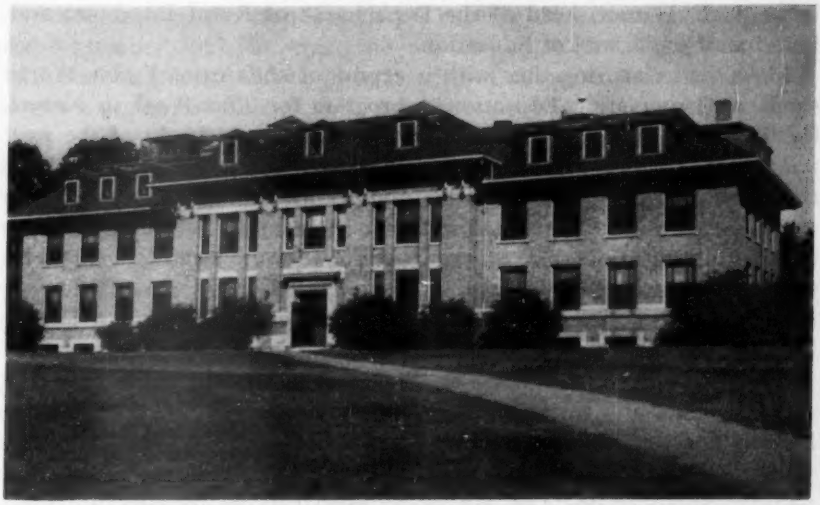
Dr. Butterworth was born in Dow City, Iowa. He received his early education there, and subsequently earned his Bachelor of Arts, Master of Arts, and Doctor of Philosophy degrees at the University of Iowa. His first teaching experience was as a teacher of English in the high schools of Waterloo and Iowa City. During the years between 1912 and 1919, he served as Professor of Psychology at Duluth, Minnesota, State Normal School, and at the University of Wyoming as Professor of Education and Dean of the College of Education. He came to Cornell in 1919 to take part in the development of the Department of Rural Education. He became head of the Department in 1931, and when, that same year, the School of Education, then known as the Graduate School of Education, was created, he became its first Director. From both positions he resigned in 1944 to give full time to teaching and research.

When Dr. Butterworth came to Cornell, no courses in secondary-school administration were offered here and few were offered elsewhere in the country. Research in the field was badly needed. Dr. Butterworth rapidly developed a program of instruction, and entered into extensive research, both as a personal undertaking and through his students. He has directed the research of thirty-five candidates for the degree of Doctor of Philosophy and one hundred for the master's degree. He was one of the earliest recognized authorities to write in his field, and is the author or co-author of ten books dealing with school finance, rural-school administration, Parent-Teacher associations, and pupil transportation. In addition he has written ten bulletins and pamphlets and eighty-five articles for educational journals. He was one of the founders, in 1926, of the Cornell Institute for Parent-Teacher Leaders, an organization which held its

twenty-sixth consecutive annual Institute at Cornell during the past year.

Dr. Butterworth has had a prominent part in many school surveys, among them studies in schools in Virginia and New Jersey, the school survey in New York in 1920-1922, the State Intermediate District study in 1944-1947, and the New Haven, Connecticut, School Survey in 1947. He was prominently identified with the central-school movement in New York, and with the later plan for larger administrative units through cooperation among school boards. He served for six years as a member of the Board of Inspectors for the North Central Association of Colleges and Secondary Schools. Dr. Butterworth's influence has been extensive also through his students, many of whom hold important administrative positions.

Dr. Butterworth will be greatly missed, and the good wishes of the group with which he has been associated and those of his students go with him and Mrs. Butterworth. Dr. Butterworth plans to continue his professional activities, and he and Mrs. Butterworth will continue to live in Ithaca where Dr. Butterworth is now devoting part time to the Cooperative Program of Educational Administration in a study of the improvement of educational administration in the Middle Atlantic Region, sponsored by the W. K. Kellogg Foundation.



Fernow Hall, home of the Cornell Rural School Leaflet

A Forward Look at the Leaflet Program

BY EVA L. GORDON

THIS number of the Cornell Rural School Leaflet marks a transition from the thirty-three-year leadership of Professor E. Laurence Palmer to a new editorship. Professor Palmer has officially retired from the Faculty of the College of Agriculture. Among the pages of this Leaflet are articles reviewing Dr. Palmer's professional life, and presenting his survey of the Cornell Nature program as he has known it. In this number, also, is noted the retirement of Professor Julian E. Butterworth, whose interest in the Leaflet is long standing, and whose influence contributed to its success, especially during the years that Dr. Butterworth served as head of the Department of Rural Education, under whose auspices the Leaflet is published.

In connection with Professor Palmer's article, it seemed appropriate to reprint Mary Rogers Miller's *Life in an Aquarium,* one of the older Cornell Leaflets to which he gives credit for a most valuable third-grade experience. A brief paragraph and a poem by Liberty Hyde Bailey, reprinted also from a collection of older Cornell Leaflets, serve to preface the article on *Achieving General Education Through Science,* by Pro-

fessor A. L. Winsor, head of the Department of Rural Education and Director of the School of Education.

These materials, together with a report of the Arnot Forest Workshops in Conservation Education, a program for *This Week in Nature* for the school year 1952–53, comments on a few new books of the past two years, and an index covering the Leaflets from September 1941 through Spring 1952 comprise this number of the Leaflet.

Children's numbers planned for 1952-53 include, for the November number, a revision of *The Story of Conservation in New York State,* by Clayton Seagears, Director of the Division of Conservation Education of the New York State Conservation Department. The original Leaflet by the same title appeared in March 1946 and has long been out of print. The growing emphasis on the teaching of conservation in the schools makes the revised edition necessary and timely. The Winter Leaflet, *Sky Laboratories,* a continuation of the popular Laboratory series, will present primarily studies in the fields of astronomy and weather and climate. The Spring number will be devoted to *Insect Homes* and will emphasize some of the ways of life of common insects.

Preparation of future Leaflets will be the general responsibility of Associate Professor Eva L. Gordon. The entire Nature and Science Education staff, however, plans to work together closely in the planning and preparation of the Leaflets, thus giving you who use them the benefit of varied backgrounds and experiences. The staff plans, also, to enlist the cooperation of specialists in the different fields of science, as Professor Palmer has done.

Dr. Gordon, who came to Cornell in 1927, from Minneapolis, Minnesota, as an experienced teacher of the elementary grades, has a twenty-five-year association with the Leaflet program, assisting in the preparation of most of the Leaflets during that period. With Paul Kellogg, now Professor of Ornithology at the University, she wrote *The Flowers of Woody Plants,* March 1930; with Professor Palmer, *Fall Weeds,* November 1930, and *Nature Writings,* September 1950. Professor Gordon prepared *The Fruits of Woody Plants,* November 1934, *The Elementary School Science Library* numbers, September 1938 and September 1949, and *Wild Foods,* March 1943.

Assistant Professor Theodore E. Eckert, whose special responsibilities are the preparation of secondary-school teachers of science and the teaching of conservation, is known personally to many readers of the Leaflet,

and also through the *Handbook for Teaching Conservation,* the Leaflet for September 1951, of which he was co-author. Dr. Eckert took his bachelor's degree at Albany State Teachers College, and his master's and doctor's degrees at Cornell, where he became a member of the staff in 1951. He has had fifteen-years experience as a teacher of secondary-school science in New York State Schools, and is co-author and author of two workbooks for secondary-school science. His doctoral study was devoted to the construction of a tentative program for conservation education in New York State. Dr. Eckert will assume major responsibility for the radio program, *This Week in Nature,* a tentative program for which appears on pages 53 and 54.

This year (1952–53) the Leaflet staff has the benefit of the wide experience of Dr. Leo F. Hadsall, visiting professor, from Fresno State College, at Fresno, California. Dr. Hadsall, a graduate of Bucknell University in Pennsylvania, took his doctor's degree at Cornell, under Professor Palmer in 1932, and went directly to Fresno. He has worked closely with the California State Department of Education to improve both elementary-science and conservation education in that State. Perhaps most significant is the fact that he was identified prominently with California's *Science Guide for Elementary-Schools,* from its inception in 1934 until its suspension in 1941 because of war conditions. The publication, issued ten times a year, went only to teachers and was designed, as its name implies and as is the Cornell Rural School Leaflet, as a guide in the science program for elementary grades.

Preparation of the Cornell Rural School Leaflet is a responsibility. It is only natural for new personnel to survey their job and to plot a course of action. This the Nature and Science Education staff wishes to do, realizing that they bring to the work differences in training, in experience, and in aptitudes. They wish to experiment in the immediate future with various types of Leaflets, both as to content and as to approach.

Later they may ask definite help from teachers in evaluating these experiments. They purposely refrain from presenting in this issue of the Leaflet definite questions but would, however, welcome informal suggestions from teachers, principals, district superintendents, and others regarding content, approach, distribution, and other phases of the Leaflet program to help guide them in their efforts to give teachers the kind of assistance they want.

Achieving General Education Through Science

By A. L. Winsor

Because of the ideological conflict in which we find ourselves, all who teach are under pressure to do something more about general education. Those teachers who assumed that they had been employed to teach specific subjects sense some confusion at this request. They are not sure what is meant by general education; neither are they sure that as subject-matter teachers they can achieve the aims and outcomes of general education. This is particularly true of teachers of science. This discussion, therefore, attempts to show how such teachers may in part achieve those purposes.

The teaching of general education is, I maintain, a social responsibility of every teacher. It represents his responsibility to the society of which he is a part, if he is to play the role of an effective citizen in maintaining that society. If the ideals and principles on which this society is based are under attack, it is his first obligation to strengthen and, when necessary, to defend those principles. The ideals and procedures of our way of life are under attack from both within and without our national boundaries. If they are to be preserved, no teacher can ignore longer his responsibility to work continuously to attain these outcomes. Furthermore, I would like to make it clear in the beginning that such an objective in education entails more skill, effort, and ingenuity than merely transmitting information.

To clarify our present problem as teachers of science in the field of general education, it is helpful to list the specific aims of such an education. As "spelled out" by the President's Commission on Higher Education, **It is the task of general education to provide the kinds of learning and experiences that will enable the student to achieve the following outcomes:**

1. **To develop for the regulation of one's personal and civic life a code of behavior based on ethical principles consistent with democratic ideals.** To me that means that the ideals of democracy as we have interpreted them in the United States, must be held constantly in the mind of every teacher to encourage personal and group behavior consistent with those principles. As interpreted by the legislators of Illinois "It is the duty of the teacher to teach honesty, kindness, justice and moral courage to raise the standard of good citizenship and to lessen crime." Simply hoisting the flag at a given time as the sole legislative requirement for effective citizenship is

not enough. No matter what a person has as a teaching assignment it includes the attitudes and values essential to the well-being of society.

2. **To participate actively as an informed and responsible citizen in solving the social, economic, and political problems of one's community, state, and nation.** This participation might well begin with cooperative school effort in such community activities as community chest drives.

3. **To recognize the interdependence of the different peoples of the world and one's personal responsibility for fostering international understanding and peace.** As the child grows away from close family ties and establishes broader community, national, and international relationships, he needs careful guidance. Visitors from other lands should no longer be branded as strangers to be avoided or misunderstood. Today they are fellow soldiers seeking the same goals of freedom and responsibility as we seek. We need their support and understanding as they need ours. We must forget our "splendid isolationism" of the past and replace it with a philosophy of mutual aid.

4. **To understand the common phenomena in one's physical environment, to apply habits of scientific thought to both personal and civic problems, and to appreciate the implications of scientific discoveries for human welfare.** Readers of this Leaflet need no amplification of this outcome. From its early beginnings the Leaflet has had as its basic objective the understanding and appreciation of common phenomena as seen at close range. Through a better understanding of nature and its laws of operation, habits of scientific method have been developed and their application to other phenomena urged.

5. **To understand the ideas of others and to express one's own effectively.** Just as we expect the teacher of English to assist with the development of better attitudes and ideas through the teaching of English, other teachers must assist them with the development of better methods of communication. Good expression, so essential in a democracy, cannot be developed in the English class alone.

6. **To attain a satisfactory emotional and social adjustment.** The teacher as much as any person outside the family circle can determine the social and emotional adjustment of children. Whether or not the child develops appropriate feelings of belonging or confidence on the one hand, or a feeling of ostracism or frustration on the other depends on the teacher, no matter what he teaches.

The best elementary teacher I ever saw at work boasted of a champion in every seat. One was the best eraser cleaner. This thoughtful teacher had found something in each person to applaud.

7. **To maintain and improve one's own health and to cooperate actively and intelligently in solving community health problems.** The high proportion of moral, mental, and physical "rejects" in our current military program should concern every teacher. Suppose the number unable or unwilling to defend our way of life was to increase. What better program of subversion could be encouraged if we were intent upon the destruction of our culture.

8. **To understand and enjoy literature, art, music, and other cultural activities as expressions of personal and social experience, and to participate to some extent in some form of creative activity.** In the light of current television, radio, and other recorded entertainment, the creation and understanding of art and literature may be neglected. As teachers, perhaps we should increase our efforts to develop an understanding and appreciation of the arts.

9. **To acquire the knowledge and attitudes basic to a satisfying family life.** The longer I live and study the problems of education, the more thoroughly I am convinced that the foundation of a sound character and of wholesome human relations is laid in the family. Whether a boy, on leaving home, is a snob or a good citizen depends more on his relationship with his parents and their example, which he observes and imitates, than upon any other influence. This relationship is either a great stumbling block or an asset to any teacher.

10. **To choose a socially useful and personally satisfying vocation that will permit one to use to the full his particular interests and abilities.** The need to select a socially useful vocation or profession has never been so urgent as it is in 1952. If all of the young men in the nation 18 years of age, each year, who are mentally capable of completing the requirement for one of the major professions were to be enrolled and educated, there would still be great shortages. The number of engineers required per thousand people, for example, has increased rapidly over the past decade and the mobilization of our manpower has exaggerated this need to such an extent that we face an engineering famine. No boy capable of becoming an engineer can be allowed to dissipate his talent if we are to maintain our new international role.

11. **To acquire and use the skills and habits involved in critical and constructive thinking.** The teacher of science has an excellent op-

portunity to encourage constructive imagination and thinking, but even laboratory exercises can degenerate into the three R's (repeating-remembering-recalling). Of course we have to learn facts, but we learn them best when they are tied in with a challenging problem to be solved.

It is clear that general education, as set forth by these aims, involves more than merely conveying knowledge or developing skills. The teacher in a general-education program is expected to arouse interest, to develop understandings and appreciations, and to establish attitudes and ideals, as well as to transmit and perpetuate the better features of our culture. Such a variety of objectives cannot be attained through class work alone. An effective general-education program must include maximum use of the social, recreational, religious, physical, and academic activities which a community provides. This means that one of the initial functions of a science teacher is to take stock of her allies in the community and be sure that all are coordinating their efforts toward these outcomes. No helpful influence should be scorned. The influences from the home, the church, or the playground may supplement or counteract the teacher's efforts unless some attempt at team work is undertaken.

It is at this point that the immature teacher of science has potentiality for harm as well as for good. In introducing scientific method and thinking to an adolescent youth whose values and ideals are not yet seasoned, lack of appreciation of the influences guiding the behavior of the boy or girl may be confusing if not tragic. The fears of William Jennings Bryan of the effect of the theory of evolution could have been realized had not science been handled generally by wise teachers. To undermine the foundations of a person's framework of values before new ones have been developed can be serious. Many potential scientists have lost their way and their usefulness when the props of the home have been knocked from under them and no one bothered to replace them with some other framework for referring life's problems. In the present state of our manpower resources, we cannot afford to develop too many Alger Hiss's.

Frequently, the coordinated efforts of other teachers, parents, brothers, and sisters, or community influences, may already have developed in a given pupil suitable general-education outcomes in some fields before the teacher undertakes to make her contribution to the child's development. It is necessary, therefore, that the teacher evaluate the attitudes and ideals of the child as thoroughly as she explores his competence in reading, spelling, or geography. His value patterns will probably show both strengths and weaknesses, and prescriptions for the weaknesses should be worked out. If he displays uncurbed self-centered behavior or anti-social tendencies, activities designed to arrest such behavior might

be more important to his general-education program than an effort to increase his rate of reading. If our social order is to hold together, all of the educational agencies must seek to develop common convictions, loyalties, and enthusiasms, and be willing to work together for their perpetuation.

At present, emphasis in general education seems to be on the need for further stressing of the common convictions, basic loyalties, and directing ideals that are assumed to be basic to our social order. The problem is one of education and group discipline, and unless we as teachers and citizens can meet this issue intelligently, our struggle with communism will fail no matter how much we know. As aids for other social groups who cherish liberty, we must understand, believe in, and pass along those principles and practices that have provided anchorage in the political storms of the past and by means of which we have been able to hold ourselves together and achieve some measure of freedom. We must neither condone nor even tolerate dishonesty in politics or government.

In addititon to teaching the necessary facts of science so they will function in interpreting the child's environment, the teacher in this field has an unusual opportunity to develop mastery in the basic skills of communication. Too often these obvious responsibilities are assumed to be the sole function of the specialized teacher and the teacher of nature study or science is inclined to shift this burden. The result is that students go through our school systems weak in the ability to listen and weak in reading, writing, and speaking skills. It should not be necessary for colleges to have to teach the arts of communication in the mother tongue, yet with twelve years of schooling our young men and women are still ineffective in these skills. We are now teaching reading and arithmetic at Cornell. Reading comprehensively and writing lucidly are arts possessed by relatively few high-school graduates. To overcome this deficiency every teacher and agency concerned with the growth of these students to positions of usefulness has an obligation to improve this condition. Even to understand and utilize effectively the facts of science, the student requires skills in communication more than in any other field. He will become skilled only as opportunity for practicing these activities under careful supervision is provided in every class and on all occasions. It is one of our social responsibilities as teachers to utilize every opportunity to improve communicative skills.

Other basic skills, such as those having to do with numerical concepts, quantitative relationships, and units of measurement, we are more apt to recognize as a part of our teaching responsibility and insist on some competence in their use. General education implies at least sufficient elementary ability in these skills to understand and control the common

phenomena in our physical environment. Too often the mathematical training in our schools is inadequate to meet our social responsibilities. The science teacher can do much to help in this field.

In science we pride ourselves upon our success in developing the so-called scientific method. This has to do with the more effective use of our intellectual power. Scientific experimentation affords an unusual medium for developing in students accuracy, honesty, persistence, patience, and initiative. They are important by-products of good science teaching, but by concerning himself with general education outcomes, the alert teacher who has the welfare of the boy or girl at heart will make these attributes not means but ends of the first order. If we can teach scientific method, we can develop also methods of precision, accuracy, and cooperation. We can teach work habits, habits of social living, and habits of responsibility, quite as well in dealing with the problems of science as in working in a shop or factory. Personal accountability for one's own standards of excellence can be developed particularly well through observation and discussion of the inexorable processes of nature. Good work habits are hard to form, and too often students emerge from our school systems with habits of carelessness and slovenly practices.

In a recent conversation, a teacher of one of our best technical high schools in New York State reported the results of a survey of opinion of the industrial employers of the school's graduates. In general, employers expressed satisfaction with the technical know-how of the products of the institution, but commonly complained about their irresponsibility with tools, their lack of consideration of property, their general indifference to the welfare of the organization. Too many of them were habitual clock watchers. The principal was rather boastful of the fact that there was no complaint about the technical knowledge which happened to be his responsibility. In my opinion, he had failed as a teacher.

In addition to developing an understanding of biological and physical sciences, and an appreciation of their contribution to the physical, intellectual, and spiritual aspects of life, the science teacher can teach the student to think clearly by recognizing when conclusions are adequately supported by data, to formulate a hypothesis, to identify a problem, and to conduct an experiment to test that hypothesis. These are all useful general-education habits that carry over into other problems of adjustment that may be met in civic, business, or industrial life.

To the extent of the individual's capacity, general education must concern itself with the cultivation of intellectual power. Such development cannot, of course, take place in a factual vacuum. Children must have facts and experience for the formulation of appropriate inferences, the interpretation of data, the organization of material, and the solving

of problems. The processes of thought and expression have to be disciplined through exercise and achievement. In much of our teaching we fail to bring about desired goals of intellectual power indispensable in dealing with our technological and social problems. Too often we impart facts but provide no urge or methods for using them. It is highly important for the teacher to remember that the first sustained systematic application of facts and experiences that many children experience is in the classroom. Work habits and thought processes can be developed in school no matter how limited the facilities, and the teacher must face his responsibility for developing them.

Because most students have a natural interest in some scientific phenomena, the enthusiastic teacher in this field has an unusual opportunity to cultivate interests and appreciations, particularly in the natural sciences, that lead to hobbies and healthful recreation practices. Every course in science has potential general-education value if the teacher has the important social values in mind when discussing natural phenomena.

Appreciation of the aesthetic in the diverse forms, colors, and arrangements found in nature is often developed by a teacher in love with his subject. From an eighth-grade teacher in love with nature, I learned to appreciate the most barren cliffs and scrubbiest foliage anywhere in America, and even to protect a lowly lizard. Instead of satisfying himself with formal informational outcomes, he built permanent and substantial values that definitely affected the way of life of his students. They became active conservationists and more constructive citizens as a result of contact with such a teacher. Certainly physical, mental, and emotional health of the young people in school can be favorably influenced through the teaching of science.

As the child emerges from childhood with narrow and self-centered interests, the science teacher has the opportunity to expand and enrich his interests and to create a zest for living unequaled in any other discipline.

Through general education, students, as indicated, are supposed to acquire knowledge of the social order, the physical universe, and their cultural heritage. Appreciative understanding of this knowledge is possible when the learner has definite contact with the facts taught. It should be relatively easier to tie understanding and appreciations of the world about us to the scientific facts when teaching arrangements are in clear contact with the physical world in which the child lives. No good science teacher is ever without a laboratory for his students.

Even human relations are best taught in the out-of-doors. Whoever has been on a camping trip with other individuals will verify the asser-

tion that a more wholesome appreciation of the worthiness of others can result from living together. Friendliness, tolerance, consideration of others, fair play, desire for justice, loyalty to group interests, and wise leadership—the foundations on which democracy rests— can all be fostered and enriched through outdoor living and studying together the wonders of nature only if the teacher has a proper regard for the development of these attitudes. Undoubtedly the sturdy moral characters that developed on the frontier during our western expansion owe much of their strength to living in close relationship to nature.

The greatest biology teacher I ever had was a hard-bitten foreman of the Grand Canyon Cattle Company, on the north rim of the Grand Canyon. He played a large part in converting that ranch into the present National Park. As a youngster I used to ride the range with him, helping to check and brand new calves. He not only identified all flowers and trees as we rode the trails, but would stop and discourse on their wonder, beauty, and importance. His greatest possession was a watch given to him by Teddy Roosevelt, and his next greatest possession was his library on nature, wrapped in burlap in a log cabin. His formal schooling was the questionable completion of the sixth grade. But he was a great teacher. Every person who rode with him had a rich experience and a greater appreciation of the world in which he lived.

By using the outdoors as a laboratory, the science teacher can come nearest to achieving the values of general education while at his work.

With educational imagination and social vision, the teacher working in the natural environment can utilize his teaching of specific facts to develop skills, attitudes, appreciations, habits, ideals, and knowledge that will help to perpetuate and safeguard our way of life. Adherence to the American tradition of democracy with its freedom and individual responsibility cannot be left to chance. The incalculable values that are identified with our culture cannot be entrusted to the slipshod methods of poor teachers in the field of citizenship. They must be the concern of every teacher who cherishes freedom and all it implies.

As I Have Known the Cornell Nature Program

By E. Laurence Palmer

Early Years and Influences

Fifty-four years ago this spring (1952), in the first-floor room to the east of the entrance of today's Cortland High School, there was a young teacher who had just changed her name from Lena Viola Lovell to Mrs. John Mumford Keese. It was my understanding that for this she was later dismissed. It was my good fortune to be in her class that spring, when she threw aside all thought of professional advancement and taught that third grade as her own good judgment said it should be taught. Under her direction I learned to love Kipling and tent caterpillars, Longfellow and spiders, George Washington and snakes, Lincoln and tree buds. I doubt that in subsequent years I ever had a more profitable educational experience than I had that spring term under a superior teacher who loved children, though she disciplined with the help of a ruler that I remember only too well.

The reason for this personal reference is that Mrs. Keese that spring distributed to her class copies of four small new bulletins that came to her from Cornell University. They were: *Some Tent Makers,* by Anna Botsford Comstock; *Directions for Collecting and Preserving Insects,* by the same author; *Life History of the Toad,* by Simon Henry Gage; and *Life in an Aquarium,* by Mary Rogers Miller.[2] Mrs. Keese helped us use the first three of these bulletins, but the fourth arrived as school was about to close. I used it during the summer. These four bulletins were so simply prepared that I, a third-grade youngster, could and did read them from cover to cover. Better yet, I used them to enrich my under-

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[2]All four bulletins were reprinted in a volume entitled *Cornell Nature Study Leaflets,* issued by the Department of Agriculture, State of New York, in 1904, and available in many libraries. *Life in an Aquarium* is reprinted on pages 38 to 51 of this Leaflet.

standing of the pond behind our house, of the field where I flew kites (the new student commons of the Cortland Teachers College stands there now), and of Otter Creek, where I caught trout, over the hill from my home. What I learned was useful to me educationally and helped to make my life more satisfying. It helped me to understand the world in which I lived and to appreciate the society of which I was a part. I believe it represented to me the best possible vehicle for general education.

As a result of having used those early Cornell publications in the third grade I learned from original sources much about insects, toads, and ponds. More important, I enjoyed learning that material. My conviction grew that it is valuable and enjoyable to learn from original sources in the natural-history field. The philosophy expressed in those bulletins affected me and helped to determine the material I contributed to the Leaflet in later years. I came to feel that poetry is a part of the whole life, that Tennyson's *Brook* with "here and there a lusty trout and here and there a grayling" was more than an ecological problem. It "bickered" and I knew from experience what that word meant. Recently, with a group of Connecticut teachers on a field trip beside a wet spot near a school, I watched two bitterns break cover and fly before us. Immediately, I quoted "I come from haunt of coot and hern," from that little verse I learned in the third grade, and we went on to a broader understanding of flood control by management of the headwaters of our streams.

Mrs. Keese helped me to combine a love of science and of the arts of expression. I have never forgotten her, and still have the little book which we used in her class.

From the standpoint of science learning, the succeeding decade was an educational desert, but I eventually got back into the biological field that I have enjoyed so thoroughly for so long. I came to Cornell as a student, and in 1910 I became an assistant in botany. Incidental to my class teaching in botany were odd jobs of various kinds. Chiefly, these consisted of answering mail sent to us by the then young College of Agriculture. Most of these bits of mail called for the identification of plants from woefully inadequate specimens, and most of the requests had been stimulated by publications still going to the rural and elementary schools of the State from the College.

During those years Miss Alice G. McCloskey was in charge of the Cornell Rural School Leaflet, a position she held from 1907 to 1915. Many of the plant identifications were made for her, and I came to know her well. Miss McCloskey could read poetry as I had never heard anyone else read it. I joined some of the groups that she took on lumber-wagon rides to the farm of Liberty Hyde Bailey. On one of these journeys I was sandwiched between a world-famous economist and a professor of biology,

each of whom exceeded my bulk and prestige enormously, but both of whom I felt I knew after that one evening. Such experiences could only help to increase my interest in the work Miss McCloskey was doing, and in the rural schools for which it was done.

Occasionally plant specimens came not by mail but at the hands of a spry little white-haired-to-bald man with a winning smile, named J. D. Bigelow, who was for many years a district superintendent of the schools of this area. He really supervised his schools. Together Bigelow and I often identified some plant a teacher had turned over to him. If the teachers had worked half as hard as we did, our task would have been much easier, but I am sure that we learned more than did they.

Eventually there came from the College of Agriculture a request that I write for the Cornell Rural School Leaflet an article telling teachers themselves how to identify plants. Accordingly, on page 158 of the September 1913 Leaflet appears the first sentence I wrote for this publication. The wisdom of Solomon was not reflected in that first sentence, but the article did recognize that people not only need help, but need help to help themselves. That idea still seems sensible to me, and I attempted to put it into practice in the Leaflets I wrote later. To enable teachers to help themselves by quick reference to condensed information was one of the reasons for the use of tabular life-history material in so many of the Leaflets.

In 1913 I accepted a position at Iowa State Teachers College in Cedar Falls as professor of botany and elementary agriculture. As the only unmarried member of the biology staff and its newest member I was given the responsibility of "doing something" about the state's rural schools. As I visited rural schools throughout that State to initiate a program in elementary agriculture, those early Cornell leaflets were most helpful in bringing to rural folk an understanding of their environment. Eighty of the earlier Leaflets had been republished in book form in 1904, as the *Cornell Nature-Study Leaflets.* That book, with Gray's *New Manual of Botany,* visited practically all counties in Iowa during the succeeding six years spent in that State except for a year at Cornell (1916-17) and a half year in the United States Navy. This Iowa experience only confirmed my conviction that Mrs. Comstock, Liberty Hyde Bailey, Simon Henry Gage, Mary Rogers Miller, and the others had based the material that underlay the Cornell nature program on a sound philosophy.

The day I got out of the Navy, I learned through accident that there was a vacancy at Cornell in the nature-study field. I loved Iowa, but I thought the Cornell situation might be worth investigating. No small

amount of reorientation was called for, because the new work was organized under an education department rather than under a biology department. I was not sure that I would like the new setting, nor that I would fit into the picture, and rather suspect that there were corresponding misgivings on the part of the folks at Ithaca.

In 1919 printed material for use in rural schools of the State had been coming from Cornell for twenty-three years. It was no light responsibility to take over leadership that had been developed by Mrs. Comstock and her associates. It was only natural that many, including the writer, were skeptical of the probable result.

Nevertheless, in September 1919, I assumed responsibility for the Cornell Rural School Leaflet, and have enjoyed that duty ever since. I felt that my years of work with elementary-school children in Iowa compensated to some extent for my lack of background in professional education, but to bolster that background I went back to school at Columbia University for a half year in 1921.

When I settled down to develop at Cornell and through the Leaflet the kind of service I felt might be needed, the distribution of the Leaflet was of necessity limited to communities of 4500 population or less, which unfortunately cut off contacts with the medium-sized communities so closely identified with rural problems. There was, however, ample opportunity for service within the prescribed framework.

The Cornell staff in education were on the whole an understanding and cooperative group. Some of them had as little understanding of my problems as I did of theirs and this, I think, was mutually appreciated. At the end of the second year, one of the group came to me with the suggestion that I was putting too much into the Leaflets, warning me that I might exhaust the field in a few years. I believed then, and still believe, that the farther one goes into the nature-study field the more possibilities unfold. "Famine" in the nature-study field comes not because of limited "food" but because of failure to see or refusal to "eat" and "relish" what is available. One of these professors once wondered how it could be possible to write four Leaflets a year, year after year. Another commented breezily that it was easy. If you had to do it, you did it, and that was all there was to it. I am sure that he was more nearly right than he himself appreciated. Later I found that I could not only write four Leaflets a year but write other things as well, besides contributing to developments outside the writing field.

I had lived for nearly twenty-five years with the nature-study philosophy of Mrs. Comstock and Liberty Hyde Bailey, the story of which, with that of the roots from which it sprang, was told in the 80-page September 1944 Leaflet. In the years that followed 1919, changes have taken place in the

Leaflet and in the nature-study program at Cornell, both in philosophy and in method. The work has grown in some directions; mistakes have been made; some convictions have been strengthened and some have been changed. It is the changes of these years that I survey here.

Development of the Leaflet and the Nature Study Program

Certainly success of the Leaflets and the nature-study program at Cornell in the past more than thirty years, would have been impossible had not the education staff been willing to lend support and provide freedom to develop wherever opportunity presented itself. Nature-study, science education, and conservation education are recognized as worthy educational disciplines at the graduate level largely because of the attitudes of the education staff that it is sound philosophy to give freedom to develop along with strict responsibility for results. Without the dynamic leadership of George Works, the brilliant insight of Paul Kruse, the kindly counselling of Ralph M. Stewart in those initial years, I am sure that little progress would have been made. George Works' word was worth more than his bond, and this bred confidence in a worker, once a pattern had been set and agreed upon. When Cornell's superior facilities for the training of teachers of natural science in the field were pointed out to Paul Kruse, he willingly underwrote, with the authority available to him, a summer course called *The Teaching of Natural History in the Field.* This course in which the students lived and studied in six different outdoor situations during summer session weekends, was, for many years, far reaching in its significance. It was suspended only when war made its continuation impossible. Such development could not have been encouraged in all institutions at all times, and credit for the work goes in large part to Professor Kruse who permitted it.

With the advent of War it seemed desirable that the Department of Rural Education make some appropriate offerings. There was a legitimate fear that our State might be bombed from the air, and there seemed to be little we could do about it. I proposed that we, of the nature-study division, offer a course designed to train persons to keep a group of other persons alive for twenty-four hours or even longer at any time of the year, independent of permanent shelter. It sounded heretic in a way, but Professor Butterworth, then head of the Department, provided the necessary sponsorship on the assurance that the undertaking would call for little financial support. As a result, for a number of years students slept in snowbanks in sub-zero weather, were rescued at night from floods, were helped to fight mosquitoes, and shown how to build shelters and fires and to prepare nourishing food with a minimum of equipment.

We chose to designate this activity not as camping, but as outdoor living. We first used the term as a Leaflet title in March 1941, but had made an earlier contribution in the field in 1923, when the Leaflet *Campfires and Camp Cookery* was issued. For years, that Leaflet was an official bulletin of the Boy Scouts of America and it still has a reasonable market through a commercial publisher.

When the camping movement was booming, with great central lodges supported by cafeterias and hot showers, we housed our camping equipment in a single closet where were to be found a few sleeping bags, tarpaulins, axes, and simple cooking equipment. When we were offered a completed camp site developed by the Federal Government, we declined on the strange conviction that camping meant camping and not cutting forests down to make tennis courts and baseball diamonds. If you had seen the little Chinese girl who had never camped in her life crawl into her sleeping bag in a snowbank in subzero weather and wake up the next morning with a smile that could be seen as far away as she could be seen, you would understand something of what I mean. We like to think that some of these students may help others, either in peace or war, to survive should dangerous situations suddenly present themselves. We believe from what we learned through these experiences that there is superior educational value in learning to live with others in difficult situations. We had to understand our environment and the society of which we were a part in order to be comfortable. A teachers college of the State, where one of the graduates of this program is now teaching, is proposing that each graduate shall have spent at least one quarter living in a camp situation. Maybe this is heretic; maybe it is sound. Certainly we have plenty of evidence that it may be one of the best examples of the working of science in general education.

It is my belief that a nature program cannot succeed without the support and cooperation of authorities in the science field. Much that parades as elementary-school science has not had that support with corresponding misfortunes. Just as the cooperation of the professional educators at Cornell provided guidance and support in the development of the nature and science-education program, so, too, did that of the staff members of the various academic science departments.

In the earlier years of the Cornell nature publications, the scientists themselves prepared material for the Leaflets. Thus, Liberty Hyde Bailey contributed *How a Squash Plant Gets Out of the Seed;* Professor George W. Cavanaugh, *How a Candle Burns;* Professor S. H. Gage, *The Life History of the Toad;* Professor R. S. Tarr, *A Handful of Soil: What It Is;* and there were many other such contributions. A different plan evolved

after 1919. When, for example, we needed a Leaflet on birds, Dr. Allen of ornithology suggested that I write it and that he would be glad to help in the planning and to criticize the material before it was published. This seemed reasonable.

Other Leaflets came into being under similar conditions. Professor Whetzel cooperated in a Leaflet on fungi; Professor Wright helped with one on reptiles and amphibians; Professor Needham with a number on limnology; the soils professors with units in their fields; Professor Gill with one on rocks and minerals; Professor Boothroyd with one on stars; Professor Harris with one on fossils; and Professor Howe with a number concerned with physics. This list might be continued almost indefinitely, as new Leaflets were issued throughout the years. It was a policy that the information and procedures of the Leaflets hold the support of both professional educators and professional scientists even if occasional conflicts had to be worked out.

The Leaflets have varied in kind throughout the years. In the earlier years, numbers covering the various fields of science seemed necessary. They dealt with such systematic groups as mammals, birds, fishes and other coldbloods, insects, invertebrates other than insects, woody plants, herbaceous plants, fungi, ferns and their relatives, and microorganisms. In the earth sciences, they dealt with rocks and minerals, the stars, weather and climate, earth forms, fossils, and earth history. A series of physical-science Leaflets included numbers on heat, light, weight, sound, electricity and magnetism, the chemical nature of matter, the physical nature of matter, and pounding and cutting tools. This series could well be elaborated in the future. Leaflets on domestic mammals, domestic birds, cultivated plants, house plants, and garden flowers continued a tradition established by the earlier writers to consider domestic organisms.

These Leaflets, too, followed a standard pattern of presenting 32 species of whatever group formed the subject of the Leaflet. Teachers who had been accustomed to "6 birds, 6 mammals, 6 trees, and 6 plants" a year objected to 32 species three times a year, overlooking the fact that we intended them to use only the material pertaining to species which were of interest locally at a given time.

Leaflets concerned with ecological subjects dealt with such places as fields, woodlands, and waterways, with separate numbers for the different seasons. Eventually this ecological approach led to the development of the "laboratory" series, which so far has included *Wet Laboratories, Wooded Laboratories, Lawn Laboratories, Paved-desert Laboratories, Window Laboratories,* and *Outdoor Laboratories,* the last-mentioned, the only teachers' number of the group. Each was designed to help teachers use effectively nearby trees or shrubs, lawns, pavements, gutters, and

windows to develop an understanding of the grasslands, deserts, forests, and waterways of the world.

A series on outdoor living has included children's Leaflets on campfires and camp cookery, safety, survival in winter, wild foods, and outdoor living; and teachers' numbers on emergency science in the out-of-doors and on outdoor education. These aimed to present not merely a series of procedures but to develop scientific principles through outdoor living experience.

When I took over the responsibility for the Leaflet, my first statement of plans, published in the *Nature Study Review*, for February 1920, was an article entitled *How the Cornell Rural School Leaflet Hopes to Teach Conservation Through Nature Study*. In those days the conservation idea did not enjoy the wide acceptance it now has. It is gratifying to feel that the Leaflet program may have had something to do with the growth of the conservation-education program. Certainly conservation education presents an excellent vehicle for science in general education. It must depend to a considerable extent on both the natural and the physical sciences, and must be concerned with the improvement of the habits of human beings who use or abuse the environment in which they live. It demands an understanding of the world about us and of worthy membership in the society of which we are a part. We can teach the principles and facts of science without doing much to modify human behavior. In the social sciences we can modify human behavior without the necessity of much knowledge of science. We cannot, however, have a sound conservation program without involving these two. Since the present general education philosophy demands a varied program that meets the specific needs of many individuals, we cannot expect success from a fixed formal program. The conservation program that succeeds will have to recognize that the interests of untrained children and of adult specialists may vary greatly.

The Leaflets definitely focussed on conservation were, for the most part, concerned with the management of environments or environmental factors. There were units on saving the soils, on vermin, on cover, on winter food for wildlife, on hedgerows, on wildfire, on fish bait, on fish and fishing, and on the management of waterways. At least four of the annual teachers' numbers have been given wholly to the teaching of conservation. An excellent unit of the series, *The Story of Conservation in New York*, was prepared by Clayton Seagears, of the New York State Conservation Department.

The Leaflet program has included, also, several numbers devoted to general topics which frequently involved several fields of science and were concerned with broad understandings. Examples are *How Things*

Move and Are Moved; Through the Year; a number on parental care: one on poisons, diseases, and medicines; one entitled *New Life;* another *Homes;* and another *Over the Ground.*

The teachers' numbers have been devoted to teaching problems, to study outlines, suggested procedures, grade placement of materials, materials to supplement the State outlines, general articles on the philosophy of education, and information on such topics as state and national parks, historical developments in the nature-study field, and New York State Indians. Two numbers, and parts of several others, with lists of current nature literature appropriate for children of elementary-school age, were prepared for the most part by Dr. Eva L. Gordon whose help and counsel throughout the years are genuinely appreciated. In the preparation of many of the teachers' Leaflets, the advice and criticism of educators at Cornell and elsewhere was given generously, and is gratefully acknowledged.

Through the years the Leaflet has had the support of many persons interested in the work. Individual numbers have been prepared by Clayton B. Seagears and Nicholas Drahos, of the New York State Conservation Department; by Leo Hadsall of Fresno State College, Fresno, California; Walter Thurber, of Cortland State Teachers College; Helen Ross, of Fitchburg State Teachers College, Massachusetts; Lois Hutchings, of Kansas Wesleyan; and Emma Davis, Wilson Clark, Theodore Eckert, Paul Kellogg, and Eva Gordon, of the Cornell faculty. One number was prepared jointly with Gustave Timmel of Cortland Teachers College, and two numbers by committees of graduate students at Cornell. Victor Schmidt of Brockport State Teachers College, Robert A. Greene of Geneseo State Teachers College, and many others have contributed.

Philosophy of Science Education

Possibly the most important conflicts in the past two decades of science education have centered around two questions, one of philosophy and the other concerning the need for scientific accuracy of factual material.

Direct experience

Those four original Leaflets to which I referred earlier dealt with caterpillars that I found on the apple trees in my side yard, with toads that bred in the pond back of my house, and with the insects of the fields and streams that I roamed. We studied tent caterpillars at the time of the year they were active in our trees. The information I was given fitted the time and the place in which I was having experiences, and the bulletins led me to experiences that were real and not vicarious. Such experiences convinced me that learning depends in large part at least on

sensory experiences with one's own immediate environment. Water, land, plants, and animals including man, all influenced me, and, I believe, influence other youngsters. So closely had I identified the learning process with sensory exploration of the immediate environment that I questioned the wisdom of asking beginning elementary-school youngsters to study what some of our birds did in South America in the winter time. The authority on which a child must base his convictions about bird behavior in South America was too remote to satisfy me.

No one could tell me that toads did not lay their eggs in strings because I had seen strings of eggs laid. I could hold similarly strong convictions about what happened to birds in winter only about the birds in my own backyard. I could find in books statements that birds spent the winter on the moon; or that some persons believed that some birds turned into frogs or even into mollusks in the fall and back into birds in the spring. I could and did question such statements, but I could not be so certain about these things as I could about the form of toad egg masses. One can lead youngsters to repeat interesting and possibly true statements about things in either remote or immediate environments about which they know nothing from direct experience, but I became convinced that that was not the way to do things. At least, vicarious experience and direct experience could not be credited with equal value.

I could not and still cannot go along with the philosophy that parental care of animals can be taught as effectively in New York by using stories of hippopotami on the Nile, salmon in the Columbia River, and prairie dogs in the Middle West as by using ants on the sidewalks, wasps under the eaves of one's home, or the kittens in the corner of the garage.

About the time that I was facing this conflict between the value of vicarious experience and direct experience I attended a lecture in Los Angeles, where I was teaching during the summer session. In the discussion that followed the lecture, a statement was made that I have always remembered, and which has greatly influenced my philosophy. One speaker had prefaced his remarks with the statement that he must be right because he had never lost a debate since his high school days many years previous. He then advanced some obviously specious arguments about the subject under discussion and the audience became restive. Finally a young man rose and asked the speaker whether he looked to authority for proof or to proof for authority. The idea caught my interest, and I began to apply it to my philosophy of nature and science education. Again and again I questioned the inclusion of some material in courses of study or in the Leaflet on the basis of whether the student could accept the authority of his own senses as proof of truth, or must accept as that proof some authority other than his own.

In the days of protests against a super-abundance of content in elementary programs, this criterion provided considerable help. All one had to ask was "Can you find the basic evidence through use of your own senses?" The study of the fox squirrel, which had been recommended for inclusion in an early Leaflet, was eliminated because at the time there were no wild free fox squirrels in the State, and none had ever been found in the northern part of the State. Instead, we recommended the study of red or gray squirrels that were reasonably abundant and of rats that were too abundant in the cities.

My conviction of the soundness of starting science work without the help of vicarious experience was so strong that I proposed that children in the first three grades be given nothing in which their authority might not be as defensible as that of their teachers. This measuring stick to determine what material to include or exclude in elementary-school programs gave the child almost equal authority with the teacher. A child could see as well as his teacher that a cat had four legs, not five. The child could defend his views because of his sensory experiences. He could develop a desirable independence of thought and a sound democratic conviction if he derived his authority from that supplied by his own experience and observation. Education became an individual thing, a goal sought by the advocates of general education.

Adherence to the idea that beginning science learning depends on basic sensory experiences within the understanding of the student, no matter how old he may be, led to conflict with other philosophies. There can be honest differences in philosophy, and anyone is entitled to hold to any philosophy he wishes, so long as its practice harms no one else. To me the remote authority idea did not and does not make sense, particularly in the initial years of a science program. To others it obviously did. After children have had enough direct experiences to develop judgment, vicarious experiences may be all right, but as a starting point they have decided limitations.

It was probably this new conviction that basic sensory experience was so important that led me to give up the imaginary stories I had been using in the Leaflet. It had helped me to think of birds as feathered dusters in Mother Nature's house, but I could not now defend that treatment. Perhaps I can illustrate the transition in my thinking through these years by reference to some of the Leaflets I wrote. My fourth Leaflet dealt with aquatic invertebrates, and was usually so listed. My college training had made my use of terms such as *aquatic invertebrates* almost automatic, but many teachers and most elementary-school pupils had no idea what that term meant. A few years later I wrote another Leaflet on invertebrates. This time I compared the variety of the creatures I discussed

with the variety of things that went into the witches' brew in Macbeth. I called the Leaflet *Witches' Brew.* This reference, too, was meaningless to many in the schools, and even an Albany official gave it an interpretation different from that which I intended. The Leaflet did not go well. More recently I wrote another Leaflet on invertebrates, especially the aquatic groups. I called it *Fish Bait.* There was no question about this title in the mind of anyone. The edition of this Leaflet was soon exhausted, for it was about something with which many persons had had direct experience and which had a broad appeal. It provided activities that could be performed by the many participants with satisfying rewards.

I believe that one can draw a suggestion from this group of experiences for modern conservation-education programs. Much that we offer children in that field deals with the basic scientific facts behind soil management. I have yet to see a satisfying conservation program based not on what adults consider important but on what interests and enlists the participation of children. Someday someone will do this.

Some critics, too, thought poetry and art and music unworthy associates of "science." I feel that science enriches and is enriched by these arts, and am inclined to think that the modern ideas of general education would reinforce this philosophy. Throughout the years I have been mindful of Mrs. Keese's emphasis in the third grade on good literature and that of Miss McCloskey on good poetry. Periodically in the teachers' numbers have appeared excerpts of the finest nature literature and poetry. Rupert Brooke's *The Great Lover,* Dallas Lore Sharp's *Five Days and an Education* and the same author's *Sanctuary,* and James G. Needham's *Common Ground of Poet and Naturalist* are examples. The September 1950 number was devoted wholly to *Nature Writings.* One children's Leaflet, November 1940, dealt with the intangibles that help to make our whole life satisfying. Of this Leaflet, *The Finer Side of Life,* I am probably more proud than of any other.

Scientific accuracy of factual material

Conflict on the question of the value of scientific accuracy in elementary-science materials arose from two sources: tests, intended to be reasonably exact instruments of educational measurement in the name of standardized tests; and textbooks for use in elementary schools. In one test which I read in 1924, a child was asked to decide which one of the following parts of a flower was colored; the sepals, petals, pistils, stamens, corolla. My first-hand experience had convinced me that any or all of these could be colored, and I did not and still do not feel that a child should have been penalized for failing to choose *petals,* the only answer acceptable to the test writer. To me, some 20 per cent of the units of this

tests were questionable. Results of this test have been used, without question, as data for at least one doctorate thesis and in other research studies. I could not condone such practices and keep the support of the botanists, zoologists, geologists, physicists, and chemists with whom I had been long associated.

A textbook which came to my desk a few years later contained a statement that the celery stalk which we eat is mainly the stem of the plant. I had been teaching that it was the leaf petiole. I could not accept what I found in that text and advised the author to that effect. The statement appeared in a subsequent edition by the same writer, was copied by other elementary-science textbook writers, and appeared in state courses of study and elsewhere. In one series it appeared at two grade levels. I use this example to preface a statement of my belief that science books planned for elementary-school teachers and pupils should present material that is basically accurate scientifically, material that need not be unlearned later, though some of it may need to be modified or further defined. Some of the textbook material that I questioned seemed to me neither elementary nor science. I preferred to be identified with the type of science called *nature study* in those first four bulletins I had had in the third grade.

The average teacher cannot be expected to judge the technical accuracy of material presented to her. She has a right to expect dependable material from institutions of higher learning, and this she has not always received. Even in this summer of 1952, a major institution described its course in elementary science as presuming no knowledge of content on the part of the student and practically guaranteeing that no survey of content would be given in the course.

Courses in Nature and Science Education

The responsibilities in the field of nature and science education at Cornell have increased greatly since 1919. Carl Becker, in his book, *Cornell University; Founders and the Founding,* comments on the unusual technique followed when he was hired to join the Cornell faculty. He was given responsibility for no classes and, in fact, was given almost no responsibilities. Freedom to make his own program, and then responsibility for what he did, seemed to be the system. I met much the same situation, except that before I came I was given responsibility for the Cornell Rural School Leaflet. I was not told how the Leaflet was to be planned nor that I might be offering course work. Certainly no mention was made of graduate work or of work outside the University circle.

During the year 1919-20, I had no teaching responsibilities. Mrs. Comstock taught her courses in nature study for one term during the year

and in summer session. I helped her with a few of the lessons in the summer of 1920, and taught a field course of my own. In the fall term of 1920, I offered a one-hour conference on the teaching of nature study. That fall, the old course, *Natural History of the Farm,* was transferred to our area, and put under my supervision for the year, at the end of which time it was discontinued. In the fall of 1921, I initiated a course for science teachers in rural high schools. When in 1935 I delegated responsibility for this course and for the training of science teachers for secondary schools to Dr. Philip G. Johnson, thirty-five students were registered in it. Dr. Victor E. Schmidt succeeded Dr. Johnson in 1946, and continued the work until 1951, when he accepted a position in Brockport State Teachers College. This field is now the major responsibility of Dr. Theodore E. Eckert, who came to Cornell with a long record of successful experience in teaching science in small-community New York State high schools. This function of the nature and science education division should not be neglected in the future, but rather should be expanded.

Among the courses offered during the years, several that represent development in different fields should perhaps be mentioned. With the retirement of Mrs. Comstock, I assumed responsibility for the teaching of the general nature-study courses. The general-methods course in this field, although it has changed with the years, is still popular. It possibly reached its greatest effectiveness when Dr. Gordon and I were offering it extramurally. She and I made it a point to visit the schools in which each of our students was teaching. This gave us a splendid contact with the field we were trying to serve.

Mrs. Comstock had initiated a course in nature literature for summer-school students. It was limited to consideration of a few writers, among them Kipling, Thoreau, Jefferies, and Burroughs. I felt that it should be expanded, and when I had the opportunity I did so. Dr. Gordon later assumed responsibility for this course, bringing to it the rewards of her doctorate thesis in the field.

In the required courses in the history of education in those earlier days, most teachers learned little or nothing of the history and development of the teaching of science and nature study. I felt that some knowledge of this field in America at least was of professional value to teachers. Accordingly, I sought and received permission to teach such a course. To make the course functional for science teachers called for visitation of areas in the country where outstanding work had been or was being done. I had intended to make extensive visits in 1926, during my first sabbatic, with the aid of a grant from the American Nature Association, but severe illness in my family greatly restricted my travel. The information collected, however, led to the publication in 1927 of the first Nature Al-

manac, written in collaboration with Arthur Newton Pack, of the American Nature Association. It presented a survey of the status of nature and science education in the United States. A second Nature Almanac was published in 1930, and we have during the years continued to keep in contact with what was going on over the country. Dr. Gordon now offers, on alternate years with the nature-literature course, a study of the origin and development of nature and science education in the United States.

Other courses have been developed to serve different areas. *Field Natural History,* now a major service course, emphasizes outdoor acquaintance with the environment, as did *The Teaching of Natural History in the Field,* a summer offering that proved to be most successful. *Outdoor Living* was designed to help meet war situations, and now, with some changes, serves the field of camping and outdoor education. *The Teaching of Conservation* was planned to help in the development of this important field; and the course *Research and Writing in Nature and Conservation Education* to help students learn to write successfully in this field. In addition to these courses, the basic courses, particularly those designed to train teachers of elementary and secondary science, have been expanded and modified to meet changing demands.

This expansion of professional offerings meant changes in the staff. In 1923-24, I carried the work alone with a $100 allowance for assistance. Now our regular staff numbers three, in addition to a graduate assistant. During the years our staff has included individuals who have made effective careers for themselves. Among these are W. P. Alexander of the Buffalo Museum of Science, Ethel Hausman of the New Jersey College for Women, John Buys of St. Lawrence University, George Hendrickson of Iowa State College, Gardiner Bump of the Fish and Wildlife Service, Philip G. Johnson of the United States Office of Education, Victor E. Schmidt of Brockport State Teachers College, Helen B. Ross of Fitchburg (Massachusetts) State Teachers College; Paul Kellogg, Eva Gordon, and Theodore Eckert of the Cornell staff; and many others.

Our graduate program has grown tremendously from one master's candidate in 1923. In 1951-52, I saw the completion of six doctorate majors and directed four others, and served on twenty-six active graduate committees. In addition, Dr. Gordon and Dr. Eckert carried substantial responsibility for other graduate work. Possibly the most important function of our graduate program has been the training of staff members for teacher-training institutions. This has been helped greatly by financial assistance from outside organizations. The graduate program probably offers as great an opportunity for professional service as any activity carried on by the staff. It is worthy of all possible support from both in

and out of the College. The work with these students has been tremendously stimulating to the staff at all times.

Contributions to the Nature Program

The work in nature study at Cornell during the past three decades has been greatly enriched through the help of organizations outside the State. In 1925, it became necessary for me to choose between continuing to work at Cornell and identifying myself wholly with the American Nature Association, publishers of *Nature Magazine.* I decided to stay at Cornell, and particularly to continue my work with the Cornell Rural School Leaflet. An arrangement, acceptable to Cornell, enabled me to give service both to the University and to the Nature Magazine program. This association has been maintained without serious change ever since, and among other benefits, led to the establishment of fellowships for graduate study, which the Association financed. These grants made it possible to provide prospective teacher-trainers opportunity for travel which they could not have financed independently. I felt that the popular questionnaire technique which formed the basis of many studies was more or less invalid. I much preferred that persons who were to teach in teacher-training institutions should visit the campuses of a few such institutions to learn from direct, not vicarious, experience what the conditions and problems were. To be able to direct these studies has been one of the most satisfying professional experiences for me in recent years at Cornell. It seemed desirable, also, that the teacher of these teachers of prospective teachers should himself know from direct experience what was going on in the world in which he lived and in the society of which he was a part. Accordingly whenever I could I accepted invitations to visit or to teach in other areas. In this way, the Cornell story was presented in credit-bearing courses in many States from coast to coast, and in Hawaii, Jamaica, Cuba, and New Zealand. Some of the better practices observed were incorporated in the Cornell Leaflet.

Other organizations as well as the American Nature Association have helped support the Cornell nature program. The Wildlife Management Institute, The National Wildlife Federation, the Conservation Foundation, the New York State Conservation Council, and the New York State Conservation Department, have at times given conspicuous and valuable assistance. In each of these cases the tendency has been to broaden and to make new applications of the content and practices previously known as nature study or elementary science.

In this issue Dr. A. L. Winsor states the role of science in general education. We like to feel that in the main, the philosophy followed through the years by the Leaflet supports Dr. Winsor's thesis. His counsel through

many years and his encouragement of projects that seemed worthy have always been appreciated.

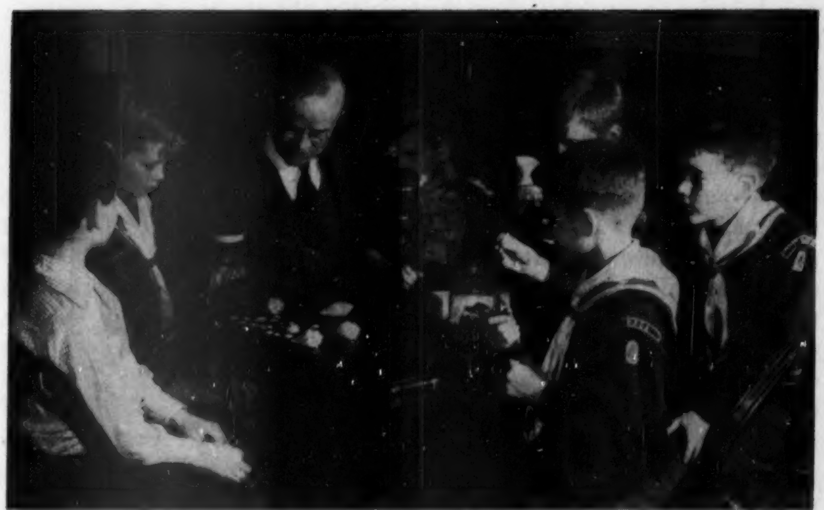
The Leaflet program obviously could not have succeeded without the cooperation of the district superintendents, the school principals, and the rural teachers of the State. Since the depression years, there has been pressure to limit the support given the Leaflet. Because of this, the personal contacts with the supervisory group during that period have been sharply curtailed. Travel to teachers' meetings has been limited and usually restricted to situations where the group involved was able to give financial support. In spite of these limitations the demand for the Leaflet has been maintained. Teachers have written in resentment that they no longer were receiving the Leaflet, but in most cases the failure had been because of lack of cooperation on the part of school administrators who should have supplied the Leaflet office with the names of their teachers. On the other hand, many supervisors have given uniformly active cooperation with the Leaflet program through the years. Others, who have had shorter periods of service, have shown similar cooperative spirit. This is genuinely appreciated.

A Final Word

Last, but by no means least, has been the downright fun of working directly or indirectly with rural children, through the Leaflets, on the radio program and sometimes through visits to schools or by correspondence. One youngster, for example, wrote regarding a statement in the Spring 1952 Leaflet, saying that he had a snake whose measurements exceeded those given as maximum for its species. Others have scrawled letters of voluntary appreciation, or have told me as adults of how the Leaflet had helped them as children. These reactions have been most gratifying rewards of the years I have worked with the Leaflet. I have enjoyed the contacts with children on our weekly radio program, *This Week in Nature,* but the real challenge has been to reach by the printed page some youngster whom I did not have the opportunity to see, some child like myself, who in the third grade got four printed bulletins from Cornell that gave his own backyard a new meaning.

Some may feel that this turning to materials published more than a half a century ago does not indicate progress. I reply that truth is always the same. Robins will lay blue eggs in mud-lined nests long after any reader of this Leaflet has gone to his last reward. Toads will lay their eggs in strings for a long time to come, and third-grade youngsters will be interested in knowing the story. Stamens, pistils, petals, sepals, and corollas of some flowers will always be colored. I take great pleasure in seeing reprinted in this Leaflet some of the material that set the pattern

I have been glad to follow in the nearly forty-year span between my first and my last official article. I only wish that other youngsters might have had the experience I had for a half year under Lena Viola Lovell Keese, or that Dallas Lore Sharp must have had with the teachers he remembered in his *Five Days and an Education,* which was printed in the September 1950 Leaflet, *Nature Writings.* I hope that in the years to come some youngsters will be interested in the writings of Gage, Comstock, Bailey, Sharp, Miller, or maybe even Palmer. It has been fun writing the Leaflets all these years. I hope it has been fun for some of you to use them. It has been fun, too, to write for the larger nature field, such glorious fun that I hope to continue to do it for the rest of my life. It now seems that this broader field offers certain challenges that cannot well be denied. For that reason, this will be the last number of the Leaflet with which I shall be identified.



This Week in Nature

Life in an Aquarium[3]

By Mary Rogers Miller

There is no more fascinating adjunct to nature-study than a well-kept aquarium. It is a never-ending source of enjoyment, interest and instruction to students of any age. Children in the kindergarten or at home will watch with delight the lively occupants, which cut all sorts of queer capers for their amusement, and older people may read some of nature's choicest secrets through the glassy sides of the little water world. To many, the word *aquarium* suggests a vision of an elaborately constructed glass box, ornamented with impossible rock-work and strange water plants, or a globe in which discouraged and sickly-looking gold-fish appear and disappear, and take strange, uncanny shapes as they dart hither and thither.

Such forms of aquaria have their place in the world, but they are not suited to the needs of an ordinary school-room. Every school may have some sort of an aquarium if the teacher and pupils are willing to give it some daily thought and care. Without such attention a fine aquarium may become an unsightly and disagreeable object, its inhabitants unhealthy and its beauty and usefulness lost.

A museum-jar aquarium (more animal life would make a better equilibrium)

The great fundamental principle underlying success in making and maintaining an aquarium is this: *imitate nature*. We all know how much easier it is to formulate a principle, and even to write a book about it, than to put it into practice. Most of us have not had the time and opportunity for the close observation of nature necessary to interpret her methods and to imitate her. It is to those teachers who are anxious to learn what nature has to teach and who wish to lead

[3]Reprinted from *Cornell Nature-Study Leaflets* (1904); originally Teachers' Leaflet 11, May 1898.

their pupils to a higher and wider conception of life, that these suggestions are offered.

Four things are important in making and keeping an aquarium:

1. The equilibrium between plant and animal life must be secured and maintained. It is probable that an aquarium in an elementary school is mainly used for the study of animal life; but animals do not thrive in water where no plants are growing. Nature keeps plants and animals in the same pond and we must follow her lead. The plants have three valuable functions in the aquarium. First, they supply food for the herbivorous creatures. Second, they give off a quantity of oxygen which is necessary to the life of the animals. Third, they take up from the water the harmful carbonic acid gas which passes from the bodies of the animals. Just how the plants do this is another story.

2. The aquarium must be ventilated. Its top should be broad and open. Every little fish, snail and insect wants air, just as every boy and girl wants it. A certain quantity of air is mixed with the water, and the creatures must breathe that or come to the surface for their supply. How does Mother Nature manage the ventilation of her aquaria,—the ponds and streams? The plants furnish part of the air, as we have said. The open pond, whose surface is ruffled by every passing breeze, is constantly being provided with fresh air. A tadpole or a fish can no more live in a long-necked bottle than a boy can live in a chimney.

3. The temperature should be kept between 40° and 50° F. Both nature and experience teach us this. A shady corner is a better place for the aquarium than a sunny window on a warm day.

4. It is well to choose such animals for the aquarium as are adapted to life in still water. Unless one has an arrangement of water pipes to supply a constant flow of water through the aquarium, it is better not to try to keep creatures that we find in swift streams.

Practical experience shows that there are certain dangers to guard against,—dangers which may result in the unnecessary suffering of the innocent. Perhaps the most serious results come from overstocking. It is better to have too few plants or animals than too many of either. A great deal of light, especially bright sunlight, is not good for the aquarium. A pond that is not shaded soon becomes green with a thick growth of slime or algae. This does not look well in an aquarium and is likely to take up so much of the plant-food that the other plants are "starved out." The plants in the school-room window may provide shade for the aquarium, just as the trees and shrubs on its banks shade the pond. If we find green slime forming on the light side of our miniature pond, we should put it in a darker place, shade it heavily so that the light comes in from the top only, and put in a few more snails. These will make quick work of the green slime, since they are fond of it, if we are not.

Some of the most innocent-looking "water nymphs" may be concealing habits that we can hardly approve. There are some which feed on their smaller and weaker neighbors, and even on the members of their own families. We know that such things go on in nature, but if we wish to have a happy family we must keep the cannibals by themselves.

After an aquarium has been filled with water and the inhabitants well established, it is not necessary to change the water, except in case of accident. The water that is lost by evaporation has to be replaced. It should be poured in gently in order not to disturb the water and destroy its clearness. If a piece of rubber tubing is available, a practical use of the siphon can be shown and the aquarium replenished at the same time. It is a good plan to use rain water, or clear water from a pond, for this purpose.

A piece of thin board or a pane of glass may be used as a cover to keep the dust out of the aquarium. This need not fit tightly or be left on all the time. A wire netting or a cover of thin cotton net would keep the flying insects from escaping, and it might be tied on permanently. Dust may be skimmed off the top of the water or may be removed by laying pieces of blotting paper on the surface for a moment.

If any of the inhabitants do not take kindly to the life in the aquarium, they can be taken out and kept in a jar by themselves—a sort of fresh-air and cold-water cure. If any chance to die, they ought to be removed before they make the water unfit for the others. Bits of charcoal in the water are helpful if a deodorizer or disinfectant is needed.

A homemade aquarium

Experience, the dear but thorough teacher, is of more value to every one of us than many rules and precepts. Nothing can rob us of the pleasure that comes of finding things out for ourselves. Much of the fun as well as much of the success in life comes from overcoming its difficulties. One must have a large store of patience and courage and hopefulness to undertake the care of an aquarium. After it is once made it is less trouble to take care of than a canary or a pet rabbit. But most things that are worth doing require patience, courage, and hopefulness, and if we can add to our store of any of these by our study of life in an aquarium we are so much the better for it.

Two kinds of aquaria will be found useful in any school. Permanent ones — those which

are expected to continue through a season or through a whole year if the school-room is warm enough to prevent freezing; and temporary ones — those which are for lesson hours or for the study of special forms.

If some one phase in the life of any aquatic animal is to be studied during a short period, it is well to have special temporary aquaria. Also, when a talk on some of the occupants of the larger aquarium is to be given, specimens may be placed in small vessels for the time being and returned later. For such purposes glass tumblers can be used, or small fruit jars, finger bowls, broken goblets set in blocks of wood, ordinary white bowls or dishes, tubs, pails or tanks for large fishes,—in fact any wide-mouthed vessel which is easy to get. Special suggestions will be made in connection with the study of some of the water insects and others.

A permanent aquarium need not be an expensive affair. The rectangular ones are best if large fishes are to be kept, yet they are not essential. Here, again, it is easier to write directions for the construction of a perfect aquarium than it is for the most patient teacher, with the help of the boys who are handy with tools, to put together a box of wood and glass that will not spring a leak some day and spoil everything. But failures do not discourage us; they make us only more determined. If a rectangular water-tight box is out of the question, what is the next best thing? One of the busiest laboratories in New York State has plants and animals living in jars of all shapes and sizes,—fruit jars, glass butter jars, candy jars, battery jars, museum jars, and others of like nature. There are rectangular and round aquaria of various sizes kept by all firms who deal in laboratory supplies, and if some money is to be spent, one of these is a good investment. [The illustration on page 40] shows a round one of small size which is useful and does not cost much.

A Good School Aquarium

A cheap, substantial aquarium for general use may be made of glass and "angle" or "valley" tin. Pieces of glass are always handy and the tin can be had at any tin-shop. The tinsmith will know just how to cut, "angle," and solder it.

The following directions for making an aquarium of this kind are supplied us by Professor C. F. Hodge of Clark University. He has made and used them for years with great satisfaction in the university laboratory and in graded schools.

The illustration [page 43] shows various sizes. A good all-round size has these dimensions: 12 inches high, 15 inches long, and 8 inches wide.[4]

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[4]*Editor's note.* Most aquarists prefer aquaria that are longer and wider than their height. Homemade aquaria, such as those described here, are usually less satisfactory and little cheaper than those for sale at pet shops or laboratory supply houses.

One may use spoiled photographic plates for small desk aquaria, in which to watch the development of "wigglers," dragon-fly nymphs or other water insects. Lids of wire screen are shown on some of the aquaria in the picture (1, 2, and 3).

To make the frame.—If the aquarium is to be 10 x 8 x 5 inches, we shall need two pieces of glass for sides 10 x 5 inches, two for ends 8 x 10, and one for bottom 8 x 5; and two strips of tin 3/4 inch wide, 28 inches long, and four strips 10 3/8 inches long. These should be angled by the tinner, and out of them we shall make the frame. The 28-inch strips should be cut with tinner's snips half way in two at 10 3/8, 5 3/8, 10 3/8, and 5 3/8 inches, cutting off the end at the last mark. This keeps the top and the bottom of the frame each in one piece. Next we bend them into shape. When the corners are well squared they should be soldered. The four 10 3/8 pieces make the vertical corners and we will solder them in place. An easy way to be sure that each angle is square is to hold it in a mechanic's square while soldering it.

To set the glass.—Lay the aquarium cement (see recipe) on evenly all around the bottom of the frame and press the bottom glass into place. Put in the sides and ends in the same way. Next carefully put a few very limber twigs into the aquarium to hold the glass against the frame till the cement takes hold. Cut off the extra cement with a knife and smooth it nicely. Cover the frame with asphaltum varnish or black lacquer. In a week it will be ready to use.

Double-thick glass must be used for large aquaria.

Cement.—Shun all resinous cements that require to be put on hot. The following is a recipe for cement used in successful angle-tin aquaria, for both salt and fresh water:

10 parts, by measure, fine, dry, white sand
10 parts plaster of Paris
10 parts litharge
1 part powdered resin

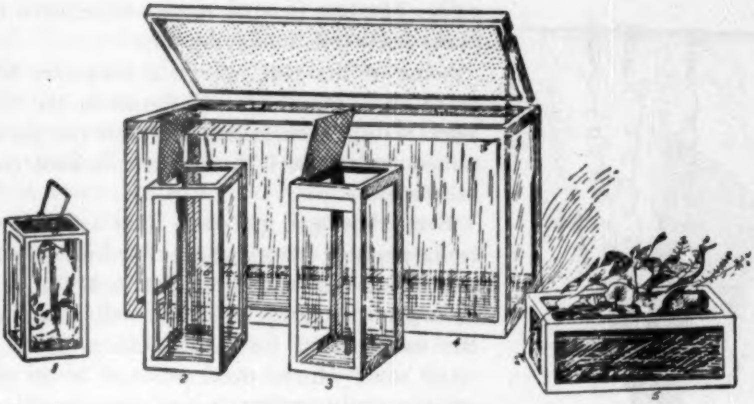
Stir well together and, as wanted, mix to consistency of *stiff* putty with *pure* boiled linseed oil.

The formula given by the U. S. Fish Commission is recommended:

8 parts putty
1 part red lead
1 part litharge

Mix, when wanted, to consistency of *stiff* putty, with raw linseed oil.

After reading all these directions and getting the idea of an aquarium, one should think the whole matter out for himself and make it just as he wants it. Directions are useful as suggestions only. The shallow form is



Permanent aquaria made of tin and glass

better for raising toads, frogs, and insect larvae; the deeper aquaria show water plants and fishes to better advantage.

Inhabitants of the Aquarium

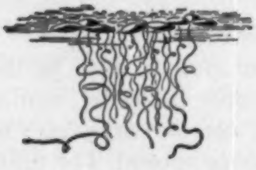
It is now time to begin to think about what shall be kept in the aquarium. At the bottom a layer of sand, the cleaner the better, two or three inches deep will be needed. A few stones, not too large, may be dropped in on top of this first layer, to make it more natural. The water plants come next and will thrive best if planted securely in the sand. The most difficult thing is to get the water in without stirring things up. A good way is to pour the water in a slow stream against the inside of the aquarium. The best way is to use a rubber siphon tube, but even then the water ought not to flow from a very great height. If the aquarium is large, it had better be put in its permanent place before filling.

The aquarium will soon be ready for snails, polliwogs, and what ever else we may wish to put into it. In the course of a few days the plants will be giving up oxygen and asking for carbon dioxide.

Plants that thrive and are useful in aquaria.—Many of the common marsh or pond plants are suitable. The accompanying illustrations show a few of these. Nothing can be prettier than some of these soft, delicate plants in the water. The eel-grass, or tape grass, is an interesting study in itself, especially at blossoming time when the spiral stems, bearing flowers, appear.

Any who are especially interested in the life-history of this plant may read in reference books a great deal about what other observers have learned from the plant concerning its methods of growth and develop-


Eel-grass


Duck-weed

ment. The best that we learn will be what the plant itself tells us day by day.

Some of the best reference books on both plant and animal life are found in the New York State Teachers' Library and can be obtained by teachers through the school commissioners.

Every boy and girl who likes to taste the fresh, peppery plants which they find growing in cold springs, knows watercress. If the aquarium is not too deep, this plant will grow above the surface and furnish a resting place for some snail which, tired perhaps by its constant activity, enjoys a few minutes in the open air.

Duck-weed or duck's-meat grows on the surface, dangling its long thread-like roots in the water. A little of it is enough. Too much would keep us from looking down upon our little friends in the water.

The parrot's feather [illustration, below, *A*] is an ornamental water plant that can be obtained from a florist; a plant that looks very like it grows in our ponds. It is called water-milfoil.

The water purslane *(B)* or the common stoneworts, *Nitella* and *Chara* *(D, E),* the waterweed *(F),* and the horn-wort *(C)* appear graceful and pretty in the water. If you do not find any of these, you are sure to find others growing in the ponds in your neighborhood which will answer the purpose just as well.


Water plants

Animals that may be kept in aquaria.—The snail. The common pond snail with the spiral shell, either flat or conical, can be found clinging to the stems of the cat-tails or flags and to floating rubbish in ponds or swamps. If these are picked off carefully and taken home in a pail of water they will be valuable inhabitants for the aquarium. They are vegetable feeders and unless there is some green slime in the water, cabbage or lettuce leaves may be put where the snails can get them. The eggs of the snail are excellent food for fishes, and if a few could be secured for special study, their form, habits and development may be made delightful observation and drawing lessons. Snails can be kept out of the water for some time on moist earth. Land snails and slugs should be kept on wet sand and fed with lettuce and cabbage leaves. The common slug of the garden is often injurious to vegetation. It may always be tracked by the trail of slime it leaves behind it. Gardeners often protect plants from those creatures by sprinkling wood-ashes about them.

Snail with conical shell

Snail

Minnows. Every boy knows where to find these spry little fellows. They can be collected with a dipper or net and will thrive in an aquarium if fed with earth worms or flies or other insects. If kept in small quarters where food is scarce, they will soon dispatch the other occupants of the jar. They will, however, eat bits of fresh meat. If the aquarium is large enough, it would hardly be complete without minnows.

Cat fish.—It will not be practicable to keep a cat fish in the permanent aquarium. If one is to be studied it can be obtained at any fish market or by angling, the latter a slow method, but one which will appeal to every boy in the class. The cat fish should be kept in a tub, tank, or large pan of water, and if not wanted for laboratory work, they might be fried for lunch, as cat fish are very good eating.

Gold fish are a special delight if kept in large aquaria. These may often be obtained from dealers in the larger cities. Those who wish other fish for study should be able to get information from the New York State Fish Culturist, concerning the species that are suited to life in still water, and how to get and take care of them.

The clam.—If empty shells are plenty on the bank of some stream after a freshet, a supply of clams may be obtained by raking the mud or sand at the bottom of the stream. They can be kept in a shallow pan, and if the water is warmish and they are left undisturbed for a time, they will move about. If kept in a jar of damp sand they will probably bury themselves. They feed on microscopic plants and might not thrive in the permanent aquarium.

Crawfish or crayfish.—These can be collected with nets from under stones in creeks or ponds. They can live very comfortably out of the water part of the time. There is small chance for the unsuspecting snail or water insect which comes within reach of the hungry jaws of the crawfish, and the temporary aquarium is the safest place for him. Many who live near the ocean can obtain and keep in sea water the lobster, a cousin of the crawfish, and will find that the habits of either will afford much amusement as well as instruction. The school boy generally knows the crawfish as a "crab".

The frog.—The study of the development of the common frog is accompanied with little or no difficulty. To be sure there are some species which require two or three years to complete their growth and changes, from the egg to the adult, yet most of the changes can be seen in one year. Frogs are not at all shy in the spring, proclaiming their whereabouts in no uncertain tones from every pond in the neighborhood. The "frog spawn" can be found clinging to plants or rubbish in masses varying in size from a cluster of two or three eggs to great lumps as large as the two fists. The "spawn" is a transparent jelly in which the eggs are imbedded. Each egg is dark colored, spherical in shape, and about as large as a small pea. The eggs of the small spotted salamander are found in similar masses of jelly and look very much like the frog's eggs. If a small quantity of this jelly-like mass be secured by means of a collecting net or by wading in for it, it may be kept in a flat white dish with just enough clean, cool

Salamander eggs

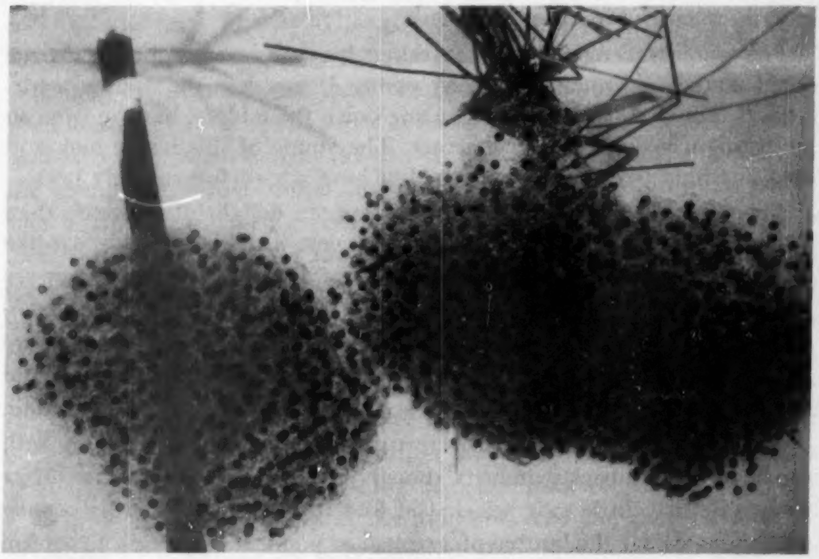
Masses like this are sometimes called "frog spawn," but differ from frog-egg masses in having an outer, thick, enclosing jelly coat. Inside are the eggs, each in its individual jelly coat.

water to cover it, until the young tadpoles are hatched. As they grow larger a few may be transferred to a permanent aquarium prepared especially for them in a dish with sloping sides, and their changes watched from week to week through the season. The growing polliwog feeds on vegetable diet; what does the full grown frog eat?

Insects that can be kept in aquaria.—Insects are to many the most satisfactory creatures that can be kept in aquaria. They are plentiful, easy to get, each one of the many kinds seems to have habits peculiar to itself, and each more curious and interesting than the last.

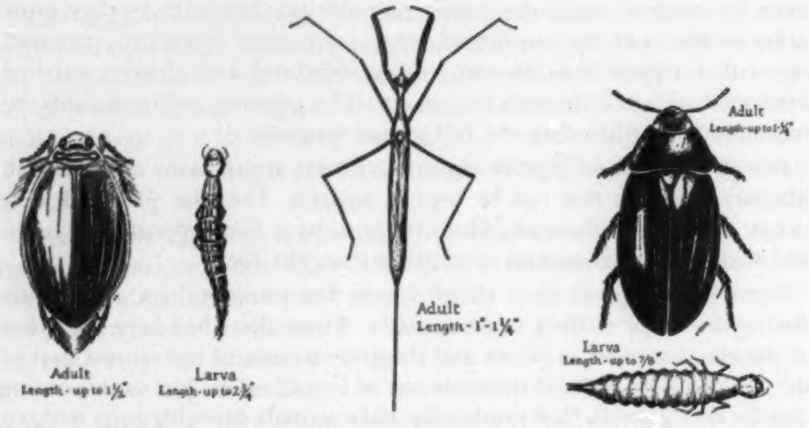
Some insects spend their entire life in the water; others are aquatic during one stage of their existence only. Those described here are a few of the common ones in ponds and sluggish streams, of the central part of the state of New York. If these cannot be found, others just as interesting may be kept instead. One can hardly make a single dip with a net without bringing out of their hiding places many of these "little people".

The predaceous diving-beetle is well named. He is a diver by profession and is a skilled one. The young of this beetle are known as "water-tigers", and their habits justify the name. Their food consists of the young of



Frog eggs

The rounded egg mass at the left is that of the wood frog; the flattened, spherical mass at the right, that of the leopard or meadow frog. Wood-frog eggs, usually the first frog eggs laid in spring, are a good choice for schoolroom observation.



Diving Beetle Water Scorpion Water Scavenger Beetle

other insects; in fact it is better to keep them by themselves unless we wish to have the aquarium depopulated. When the tiger has reached his full size, his form changes and he rests for a time as a pupa; then comes forth as a hard, shiny beetle.

The water-scavenger beetle, so called because of its appetite for decayed matter, is common in many ponds. It has, like the diving beetle, a hard, shiny back, with a straight line down the middle, but the two can be distinguished when seen together. The young of this beetle look and act something like the water-tigers, but have not such great ugly jaws.

There are three other swimmers even more delightful to watch than those already mentioned. The water-boatmen with their sturdy oar-like legs and business-like way of using them, are droll little fellows. They are not so large as the back-swimmers. These creatures swim with their boat-shaped backs down and their six legs up. We must be careful how we handle the back-swimmers, for each one of them carries a sharp bill and may give us a thrust with it which would be painful, perhaps poisonous.

The water-scorpion is a queer creature living in a neighborly way with the boatmen and back-swimmers, though not so easy to find. Do not throw away any dirty little twig which you find in the net after a dip among water plants near the bottom of a stream or pond. It may begin to squirm and reveal the fact that it is no twig but a slender-legged insect with a spindle-shaped body. We may handle it without danger, as it is harmless. This is a water scorpion, and his way of catching his prey and getting his air supply will be interesting to watch. He is not shy and will answer

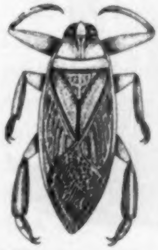
questions about himself promptly and cheerfully. [The illustration] will give an idea of the appearance of this insect.

Temporary aquarium, containing eggs, larvae and pupae of mosqüito

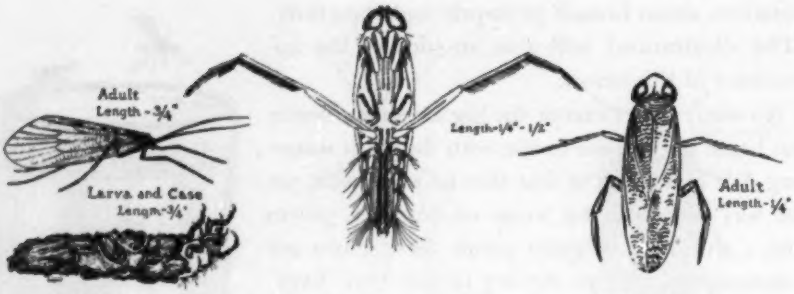
No water insect except the big scavenger beetle can begin to compare in size with the giant water-bug. We may think at first that he is a beetle, yet the way he crosses his wings on his back proves him a true bug. In quiet ponds these giants are common enough, but the boy or girl who "bags" a full-grown one at the first dip of the net may be considered lucky.

The boatmen, back-swimmers and giants all have oars, yet are not entirely dependent on them. They have strong wings, too, and if their old home gets too thickly settled, and the other insects on which they feed are scarce, they fly away to other places. The giant water-bug often migrates at night, and is attracted to any bright light he sees in his journey. This habit has given him the popular name of "electric-light bug." [Giant water-bugs too can inflict a painful "bite."]

Among the insects which spend but part of their life in the water, we shall find many surprises. It made us feel queer when we learned that the restless but innocent-looking wiggler of the rain-water barrel was really the young of the too familiar mosquito. The adult mosquito leaves its eggs in tiny boat-shaped masses on the surface of stagnant water, where food will be abundant for the young which soon appear. Some time is spent by the wigglers in eating and growing before they curl up into pupae. Insects are rarely active in the pupa stage. The mosquito is one of the very few exceptions. From these lively pupae the full-grown mosquitoes emerge. [An illustration on this page] shows a small glass tumbler in which are seen the three aquatic stages of the mosquito's life and an adult just leaving the pupa skin. Nothing is easier than to watch the entire development of the mosquito, and the changes must be seen to be fully enjoyed and appreciated. It would be interesting to note the differences between the mosquitoes that come out of the small aquaria. A supply of wigglers may be kept in the permanent aquarium where they serve as food for the other insects.



Giant water-bug



Caddis Fly   Back-swimmer   Water Boatman

Every child knows the dragon-fly or darning-needle, and none but the bravest of them dare venture near one without covering ears or eyes or mouth, for fear of being sewed. Many and wide-spread are the superstitions concerning this insect, and it is often difficult to bring children to believe that this creature, besides being a thing of beauty, is not only harmless but actually beneficial. If they knew how many mosquitoes the darning-needle eats in a day they would welcome instead of fearing the gay creature.

The young of the dragon-fly live a groveling existence, as different as can be from that of their sun-loving parents. Their food consists of mosquito larvae, water-fleas and the like, and their method of catching their prey is as novel as it is effective. Pupils and teacher can get plenty of good healthy entertainment out of the behavior of these awkward and voracious little mask-wearers. The first dip of the net usually brings up a supply of dragon-fly nymphs and of their more slender cousins, the damsel-fly nymphs. The latter have expanded plate-like appendages at the hind end of the body which distinguish them from the dragon-fly nymphs.

The life-history of a dragon-fly as seen in an aquarium

The transformation of one of these young insects into an adult is

one of the most interesting observation lessons that can be imagined for a warm spring morning. If a dragon-fly nymph should signify its intention of changing its form in my school-room, I should certainly suspend all ordinary work and attend to him alone. Each child should see if possible this wonderful transfiguration.

Floating in the water of a pond or stream one may find a little bundle of grass or weed stems, with perhaps a tiny pebble clinging to the mass. Close examination will prove this to be the "house-boat" of one of our insect neighbors, the caddice-worm. Contrasting strangely with the untidy exterior is the neat interior, with its lining of delicate silk, so smooth that the soft-bodied creature which lives inside is safe from injury. [One of] the commonest of the many forms of houses found here [is] illustrated. These will find all they wish to eat in a well-stocked aquarium. When full grown they will leave the water as winged creatures, and return to its depths no more.

There is surely no lack of material furnished by Mother Nature for the study of aquatic life. Every one who really believes in its usefulness can have an aquarium, and will feel well repaid for the time and effort required when the renewed interest in nature is witnessed which this close contact with living beings brings to every student. Let us take hold with a will, overcome the difficulties in the way, and teacher and pupils become students together.

The Arnot Forest Workshops in Conservation Education

By Theodore E. Eckert

During the past four summers, nearly 200 teachers, supervisors, school principals, district superintendents, staff members from the state teachers colleges, and officials from the State Education Department have been given basic experiences in conservation and conservation teaching techniques at the Arnot Forest Camp near Ithaca.

The Arnot Forest is a tract of 4,009 acres about 15 miles southwest of Cornell University on the Tompkins-Schuyler County Line. The area is partly wooded, partly idle land, and partly pasture land and experimental plots or fields. Several permanent buildings, most of which were parts of a Civilian Conservation Corps camp, serve as headquarters for the conference. A United States soil-conservation–soil-erosion experiment station, a farm pond, and examples of several types of conservation practices are on or near the area. Thus persons attending the conference have an excellent opportunity for group living and to observe the multiple uses of lands from which the original forest cover has been removed.

Teachers from 49 counties in New York State have attended these sessions. Some teacher who has profited from this training may be teaching in your school or in a nearby school. Possibly a meeting could be arranged to enable this teacher to share experiences with your group.

The instructional program is of the outdoor type. Field instruction and demonstrations deal with the problems of conserving soils, water, woodlands, and fish and wildlife, and present methods and materials for teaching conservation. The needs and problems of the classroom teacher have been recognized and the teaching methods presented are suited to use in the classrooms and on school grounds anywhere in New York State.

The teaching staff, consultants, and speakers for the program have included personnel from the New York State College of Agriculture at Cornell, the State Department of Conservation, the State Education Department, public school systems, private organizations, and competent individual citizens. This training is maintained through yearly grants from the New York State Conservation Council and the use of the staff and facilities of the New York State College of Agriculture at Cornell University. Numerous federal and state agencies, departments and institutions, and private industrial and business organizations also have contributed valuable reference and teaching materials.

In the effort to provide adequate instruction in the conservation of natural resources no person is more important than the classroom teacher. Most teachers want teaching materials, information on conservation content, suggested pupil activities, and suggested ways to use facilities immediately at hand. Perhaps 1953 is the year for you to attend the Conservation Workshop at the Arnot Forest, probably the third week of August. Later this year your district superintendent and your principal will have an opportunity to indicate whether they plan to recommend a person from your school. If you want to be among those selected, inform your principal and your superintendent now that you wish to be recommended.

New Books for Science Teachers

Conservation Education in American Schools. By American Association of School Administrators, National Education Association of the United States, Twenty-ninth Yearbook, Washington, 1951.

This book was prepared as an administrator's guide in the area of conservation education. In chapters one and two basic conservation problems and methods of solving these problems are briefly discussed. The remaining eight chapters deal specifically with guides for developing

school programs in conservation education, instructional materials and facilities, practices in rural and urban schools, state and regional programs, teacher education, and administrative leadership. The 64-page appendix, including selected references, audio-visual aids, and lists of organizations and agencies concerned with conservation, is perhaps the best treatment of this useful information available. Although this book presents relatively little of specific use to the classroom teacher, it is definitely useful to the administrator, curriculum committee, or teacher group attempting to develop an effective school program in conservation education. *Theodore E. Eckert*

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Methods and Activities in Elementary School Science—Elementary School Science and How to Teach It. By Glenn O. Blough and Albert J. Huggett. The Dryden Press, New York City, 1951. 310 pages and 532 pages respectively. Material in the first book is duplicated in the second.

These two books sincerely try to meet the needs of elementary teachers who have little training in science. About 200 pages in each book suggests things for pupils and teachers to do in and out of the classroom. These suggestions are clearly written and completely practical; they are well distributed over the various areas of science. They err in frequently encouraging hasty generalization, a practice we should discourage.

The second book contains about 200 pages of material designed to give teachers the needed informational background. The authors have attempted to crowd so much in so little space that the necessarily superficial treatment may sometimes do as much harm as good.

Each book has a section on philosophy and general methods. This is written in simple style well salted with descriptions of real classroom situations. Each book ends with an extensive and valuable list of books and other teaching materials. *Walter Thurber*

This Week in Nature Radio Series

By Theodore E. Eckert

The radio series, "This Week in Nature," continues as a service supplementing that of the Cornell Rural School Leaflet. The programs of the series are presented Fridays at 2:00 P. M. on Station WHCU-AM and on the Rural Radio Network-FM Saturday mornings at 9:45 A. M.

The programs offered usually consist of lessons in nature study, in elementary science, or in conservation. Elementary-school and junior-high-school children participate and the program leaders are experienced nature-study and science teachers.

For your convenience in planning to make the most effective use of the radio lessons in your teaching, the list of programs planned for the 1952-53 school year is included. The unannounced programs are reserved for lessons on timely events and for spontaneous lessons of interest to the children participating.

Oct.	2 and 4	Seeds
	9 and 11	Nuts
	17 and 18	Colored leaves
	24 and 25	Muddy waters in Fall
	31 and Nov. 1	
Nov.	7 and 8	Birds' nests
	14 and 15	Insects in winter
	21 and 22	Science with kitchen utensils
	28 and 29	Squash, pumpkins, and other fall fruits
Dec.	5 and 6	Christmas greens
	12 and 13	Christmas trees
	19 and 20	Christmas toys
	26 and 27	
Jan.	2 and 3	Noise makers
	9 and 10	
	16 and 17	Winter foods for wildlife
	23 and 24	Jet propulsion
	30 and 31	The winter skies
Feb.	6 and 7	Winter weeds
	13 and 14	
	20 and 21	Animal tracks in the snow
	27 and 28	Twigs in winter
Mar.	6 and 7	Tree barks
	13 and 14	
	20 and 21	Spring comes
	27 and 28	Spring thaw
Apr.	3 and 4	Swelling buds
	10 and 11	Germinating seeds
	17 and 18	Clouds
	24 and 25	
May	1 and 2	New growth
	8 and 9	Insects in spring
	15 and 16	Spring flowers
	22 and 23	Save our spring flowers
	29 and 30	
June	5 and 6	Shadows
	12 and 13	Summer skies
	19 and 20	Vacation plans
	26 and 27	Summer safety

An Index to the Cornell Rural School Leaflet

September 1941 to Spring 1952, inclusive

BY E. LAURENCE PALMER, EVA L. GORDON, AND HENRY GREENFIELD

THIS index covers the issues of the Cornell Rural School Leaflet from September 1941 to the present. It continues an index published in the September 1941 Teachers' Number, which covered the material published during the preceding ten years, and earlier indexes published in September 1931 and September 1919.

References are grouped wherever possible, rather than listed alphabetically. The notations give the volume first, the number within the volume second, and the page or pages third. The numbers within the volumes refer to the month of publication; that is, *1* refers to a September Leaflet; *2* to November; *3* to January; *4* to March. Thus, 36^2: 5-30 means volume 36 (1942-43), number 2 (November), pages 5 to 30. Page numbers separated by a hyphen indicate continuous material; those separated by commas mean short references.

Those schools that have the Leaflets published during the period covered by this index may want to have a set of the Leaflets bound with this September (1952) number. This would preserve individual copies for future use, and the index would help one to find references easily. Probably the information published during these past years will not be republished within the next few years.

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